

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant: Curtis A. Richardson et al.)
) Group Art Unit: 1745
Serial No.: 10/607,603)
)
Filed: 06/27/2003) Examiner: Alejandro, Raymond
)
Title: GAS-FILLED GASKET FOR A SOLID-OXIDE FUEL CELL ASSEMBLY

Mail Stop: Appeal Brief - Patents

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

SUBSTITUTE APPEAL BRIEF

Sir:

This Substitute Appeal Brief is submitted in response to the Notification of Non-Compliant Appeal Brief mailed April 26, 2007.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Delphi Technologies Inc.

II. RELATED APPEALS AND INTERFERENCES

Applicants, Applicants' legal representatives, and assignee are not aware of any related appeals or interferences.

III. STATUS OF CLAIMS

Claims 5-7 are currently pending and are the claims on appeal. Original claims 1-4 and 8 have been cancelled.

Claim 5 was rejected under 35 U.S.C. § 103 as being unpatentable over the PCT Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent No. 6,231,053, by Wakamatsu.

Claim 5 was rejected under 35 U.S.C. § 103 as being unpatentable over the Patent Application Publication WO 01/17048, by Nagai, in view of Japanese patent publication 06-96783, referred to as JP '783.

Claim 5 was rejected under 35 U.S.C. § 103 as being unpatentable over the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent Application Publication 2004/0053099, by Franklin et al.

Claims 6 and 7 were rejected under 35 U.S.C. § 103 as being unpatentable over the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent No. 6,231,053, by Wakamatsu; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of JP '783; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent

Application Publication 2004/0053099, by Franklin et al. as applied to claim 5, and further in view of U.S. Patent Application Publication No. 2003/0150162, by Inagaki et al.

IV. STATUS OF AMENDMENTS

Applicants filed an Amendment under CFR 1.116 on April 21, 2006 after the Final Office Action. The Examiner entered the Amendment in an Advisory Action on April 27, 2006.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 5 is directed to a fuel cell assembly. See fuel cell assembly 43 in Fig. 4; and page 5, lines 7-10. The fuel cell assembly includes first and second components in spaced, parallel relationship. See plates 41 and 42 in Fig. 4; and page 5, lines 7-10. The fuel cell assembly further includes a gasket disposed between the first and second components, the gasket being formed of first and second sheet metal elements. See gasket 10 in Fig. 4 disposed between mounting plate 41 and top plate 42; gasket 10 having first and second sheet metal elements 31 and 32 in Fig. 2; page 4, lines 21-23; and page 5, lines 4-16. The gasket includes a planar region having an opening therein for passage of gas between the first and second components, the first and second sheet metal elements being bonded at the planar region. See planar region 26 and openings 12, 14, 16, 18, 20 and 22 in Fig. 1; and page 4, lines 9-13. The gasket further includes a pillow structure surrounding the opening and extending from the planar region. See pillow structure 28 in Figs. 1, 2 and 4 that surround the openings; and page 4, line 16. The pillow structure defines a gas-filled chamber enclosed with the first and second sheet metal elements

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and being diffusion bonded to the first and second components to form a sealed joint therebetween. See pillow structure 28 in Fig. 2 having chamber 30 enclosed with first and second elements 31, 32 and bonded to mounting plate 41 and top plate 42; and page 4, lines 17-26, and page 5, lines 4-16.

Dependent claim 6 recites that the fuel cell assembly of claim 5 is an auxiliary power unit for a vehicle. See auxiliary power unit 60 and car 62 in Fig. 4 and page 5, lines 21-23.

Dependent claim 7 recites the fuel cell assembly of claim 6 wherein the vehicle is selected from the group consisting of car, truck, boat, ship, airplane, and space vehicle. See car 62, truck 64, boat 66, ship 68, airplane 70 and space vehicle 72 in Fig. 4; and page 5, lines 21-26.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claim 5 is unpatentable under 35 U.S.C. § 103 over PCT Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent No. 6,231,053, by Wakamatsu.

Whether claim 5 is unpatentable under 35 U.S.C. § 103 over the PCT Patent Application Publication WO 01/17048, by Nagai, in view of Japanese patent publication 06-96783, referred to as JP '783.

Whether claim 5 is unpatentable under 35 U.S.C. § 103 over the PCT Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent Application Publication 2004/0053099, by Franklin et al.

Whether claims 6 and 7 are unpatentable under 35 U.S.C. § 103 over the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent No. 6,231,053, by Wakamatsu; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of JP '783; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent Application Publication 2004/0053099, by Franklin et al. as applied to claim 5, and further in view of U.S. Patent Application Publication No. 2003/0150162, by Inagaki et al.

VII. ARGUMENT

Claim 5 Rejection based upon Nagai in view of Wakamatsu

Applicants' invention relates to a gasket 10 for use in a fuel cell assembly 17, see Figs. 1-4, particularly Fig. 4. The assembly includes a plurality of fuel cells. Each fuel cell comprises components that define compartments for containing a reducing gas, e.g., hydrogen, and compartments for containing oxidizing gas, e.g., oxygen, separated by a membrane. The components include plates 41 and 42 in Fig. 4. To increase the electrical output, a plurality of cells are arranged in a stack to form the assembly. Within the stack, the components are spaced apart by gaskets 10. The gaskets have openings 12, 14, 16, 18, 20 and 24 that surround openings

in the peripheral regions of the plates 41 and 42 and cooperate with them to form manifolds for conveying the reactant gases to the cells and removing product gases.

The gaskets of the present invention have features to improve their performance, particularly at elevated temperatures.

First, gaskets 10 of the present invention are formed of metal, page 4, lines 21-23. During operation, the temperature of the fuel cell assembly increases. Metal gaskets allow the fuel cell to operate at higher temperatures at which polymeric materials tend to degrade. The metal gaskets withstand the higher temperatures, and so provide a more durable assembly and extend the useful life of the assembly. This is particularly advantageous for fuel cells that employ reducing gas that is reformed gas manufactured by reforming hydrocarbon compounds at elevated temperatures, because the reformed gas may be fed into the assembly at the elevated temperature without cooling.

The metal gaskets of the present invention maintain the desired spaced relationship between the components. For this purpose, the metal gaskets 10 comprise a pillow structure 28 in Figs. 1-2, 28' in Fig. 3, clearly shown, but unnumbered in Fig. 4, that defines a gas-filled chamber 30 or 30'. During operation, the assembly experiences thermal cycling that causes the components to expand and contract. The gas within the chamber of the pillow structure expands

and contracts to maintain the gasket in contact with the adjacent components, and so maintain the separation between the components.

Pillow structures 28 or 28' of the metal gaskets of the present invention form hermetic seals to the adjacent components about the openings that form the manifolds to convey gases to and from the reaction compartments. As discussed above, the gas within the chambers of the pillow structures expands and contracts to maintain the gasket pressed against the adjacent components, page 4, lines 27-30. Also, the pillow structure is diffusion bonded to the adjacent components, page 5, lines 4-16. The result is a hermetic seal that is not broken despite thermal cycling of the fuel cell assembly during use.

The rejection points to Fig. 2 in Nagai. (For purposes of the discussion herein, reference is made to U.S. Patent No. 6,720,103, by Nagai). Nagai provides an arrangement that is formed of elastic resin gasket sheets 6 and 7, col. 3, lines 29-30. The sheets are composed of polyester, polyamide, polyimide, and polyethylene naphthalate, col. 4, lines 49-51. A stainless steel spacer sheet 5a is interposed between the sheets, col. 4, lines 57-58. The spacer 5a is a critical component of Nagai necessary to maintain separation between the separators 2 and 3, col. 4, lines 34-40. It is significant that the spacer region does not seal the gap between the adjacent components. Rather, sealing in Nagai is provided by gaskets 8 and 9, which are formed of cured rubber and are located apart from spacer 5a, col. 3, lines 41-49.

Claim 5 calls for a gasket that is formed of metal sheets. Nagai teaches gaskets 8 and 9 that are formed of rubber. Even if the entire edge structure is considered as a gasket, as the rejection does, the edge structure in Nagai is formed of polymeric sheets. Nothing in Nagai suggests replacing the polymeric material with metal. Claim 5 calls for a gasket that includes a pillow structure. The rejection points to the region of spacer 5a as corresponding to the pillow structure. First, it is precisely because the arrangement in Nagai is formed of polymeric sheets and not metal that Nagai must provide a metal spacer to separate the components. The polymeric sheets do not provide sufficient rigidity to support the components, particularly at elevated temperatures. On the other hand, because of the metal spacer 5a, the region is not a pillow structure. Implicit in a pillow structure is a suitable compliance that is exactly opposite the object of the spacer in Nagai. Still further, claim 5 calls for the pillow structure to be diffusion bonded to the components to form a sealed joint therebetween. Nagai does not bond the spacer region to the adjacent components, and provides gaskets 8 and 9 for sealing. Thus, Nagai does not teach or suggest Applicants' invention in claim 5.

The rejection points to the empty spaces to the sides of the spacer 5a in Nagai. However, the critical spacer component defines the gap between the adjacent components and is formed of solid metal. Because of the metal spacer, the air spaces are nonfunctional, and the overall structure is designed to maintain the separation between the adjacent components, and so is essentially unyielding. That is, the spacer structure is hard, and is neither soft nor compliant nor any other property attributable to a pillow. Further, it is precisely because the edge structure is

formed of compliant polymeric sheets, and not metal sheets, that Nagai needs the spacer. Thus, the spacer region in the Nagai cannot be fairly characterized as a pillow structure corresponding to Applicants' invention.

The rejection acknowledges that Nagai describes polymeric sheets, not metal sheets, as in Applicants' invention. The rejection points to Wakamatsu to show a gasket having a metal sheet.

Wakamatsu describes a gasket 1 that comprises a frame 2 that may be formed of metal, col. 3, line 45-52. Frame 2 is covered by sealant 6 composed of elastomeric material, preferably a liquid rubber vulcanizate, col. 3, lines 62, to col. 4, line 17. Thus, the gasket in Wakamatsu comprises metal bounded by elastomeric material and is like Nagai in this regard. It does not show a gasket formed of metal sheets that are bonded together, or define a gas-filled chamber or are diffusion bonded to the adjacent components. Thus, Wakamatsu does not teach or suggest Applicants' invention in claim 5.

Even if combined, the references do not lead to Applicants' invention. There is nothing in either reference that points the practitioner to gasket that is made of bonded metal sheets and not out of polymeric elements. Polymeric materials are known to the practitioner to be compliant and to form good seals, in contrast to metals. Since the references do not contemplate a gasket formed out of metal sheets, they do not point to the pillow structure in Applicants' metal gasket that defines a gas-filled chamber and is bonded to the components to form a sealed joint. Yet it is

because of the pillow structure and the diffusion bonding that Applicants' invention is uniquely able to avoid the problems of a solid metal spacer across the gap as shown in Nagai, and to eliminate polymeric materials that tend to degrade at the elevated operating temperature of the fuel cell.

Claim 5 is directed to Applicants' fuel cell assembly that includes a gasket formed of sheet metal elements and having a planar region at which the sheet metal elements are bonded. Neither Nagai nor Wakamatsu show a gasket formed of metal sheets bonded together. Claim 5 calls for a pillow structure that includes a gas-filled chamber. Because of the metal spacer, the spaces about the spacer in Nagai do not make the region a pillow structure; and since the arrangement is formed of polymer not metal, there is nothing in Nagai to suggest eliminating the metal spacer to allow the space to act as a pillow structure. Still further, claim 5 recites that the sheet metal elements are diffusion bonded to the components to form a sealed joint. Diffusion bonding is a metallurgical bond formed between metals, in contrast to adhesive bonding and the like. Nagai forms a seal by providing separate gaskets 8 and 9, and does not contemplate to bond the sheets in the region of the spacer. Wakamatsu also uses a polymeric bead to form the seal. Because both references rely on polymeric materials to form the seal, neither contemplates a metallurgical bond. For these reasons, the practitioner, aware of Nagai and Wakamatsu, is not lead to Applicants' fuel cell assembly in claim 5.

In the Advisory Action mailed April 27, 2006, an attempt is made to justify the rejection by interpreting piecemeal sections of the claim wording in a manner to read on the cited art, particularly Nagai. The standard in 35 U.S.C. § 103(a) is whether “the subject matter as a whole would have been obvious” from the cited art. A fair reading of the teachings of Nagai does not lead the skilled practitioner on an obvious path to Applicants’ invention. Nor does Wakamatsu lead the practitioner to make obvious changes to the teachings of Nagai so as to arrive at the Applicants’ invention. A reading of the claim as a whole reveals the differences. The differences are not obvious from the prior art. And so, Applicants have met the standard of Section 103(a) and are entitled to a patent.

Accordingly, it is respectfully requested that the rejection of the claim 5 based upon Nagai and Wakamatsu, be reconsidered and withdrawn, and that the claim be allowed.

Claim Rejection based upon Nagai in view of JP ‘783

Claim 5 was rejected under 35 U.S.C. § 103 as unpatentable over Nagai in view of Japanese patent publication 06-96783, referred to as JP ‘783.

The rejection refers to the Abstract of JP ‘783, but did not include an English translation thereof. In the discussion herein, reference is made to an English translation of JP ‘783 obtained from the database of the Patent Abstracts of Japan, a copy of which was enclosed with Applicants’ Response mailed June 13, 2006.

For all the reasons set forth above, Nagai does not show a gasket formed of metal sheets that are bonded together. Because the metal spacer is a critical element in Nagai, it does not suggest to provide a pillow structure between the metal sheets, which allows the metal sheets to be used as a gasket in Applicants' invention. Further, because Nagai teaches the use of separate gaskets apart from the spacer region, there is nothing to suggest bonding the region to the adjacent components to form a sealed joint, as in Applicants' invention.

JP '783 discloses a gasket 21 formed of a silicone sheet, Example 1, paragraph 0012 (although the translation reads "silicon," the practitioner would understand that silicone was intended). Example 2 describes foam rubber sheets about a metal sheet, paragraph 0013. Nothing in JP '783 shows a gasket formed by metal sheets bonded together and diffusion bonded to the adjacent components. Without this, even if combined, JP '783 does not lead the practitioner to replace the polymer sheets in Nagai with metal sheets. Moreover, there is nothing in JP '783 to not lead the practitioner to eliminate the metal spacer from Nagai to form a pillow structure, as in Applicants' invention. Still further, neither JP '783 nor Nagai bond the gasket, or more particularly, the metal sheet within the gasket, to the adjacent components. Thus, the references do not point to a pillow structure formed of bonded metal sheets that are in turn bonded to the adjacent components to form a seal, in accordance with Applicants' invention as recited in claim 5.

Accordingly, it is respectfully requested that the rejection of the claim 5 based upon Nagai and JP '783, be reconsidered and withdrawn, and that the claim be allowed.

Claim Rejection based upon Nagai in view of Franklin et al.

Claim 5 was rejected under 35 U.S.C. § 103 as unpatentable over Nagai in view of U.S. Patent Application Publication US 2004/0053099, by Franklin et al. .

For all the reasons set forth above, the metal spacer embedded in the polymer sheets with the separated gasket elements in Nagai does not suggest a gasket formed of metal sheets with a pillow structure that is bonded to the adjacent components, and so does not show Applicants' invention in claim 5.

Franklin et al. is applied to show a gasket for a fuel cell that includes a plastic polymer material, an elastomeric material, a composite material, a metallic material, a foam material or combinations thereof. However, Franklin et al. does not point the practitioner to eliminate the spacer in Nagai. Nor does Franklin et al. point the practitioner to replace the compliant polymer sheets in Nagai with metal sheets and/or form the pillow structure in Applicants' gasket. Nor does Franklin et al. point the practitioner to bond the spacer region in Nagai to the adjacent components, instead of using the remote gaskets provided by Nagai for the purpose of sealing the gap. Thus, even if combined, the references do not suggest Applicants' invention as set forth in claim 5.

Accordingly, it is respectfully requested that the rejection of the claim 5 based upon Nagai and Franklin et al., be reconsidered and withdrawn, and that the claim be allowed.

Rejection of Claims 6 and 7

Claims 6 and 7 were rejected under 35 U.S.C. § 103 as being unpatentable over the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent No. 6,231,053, by Wakamatsu; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of JP '783; and/or the Patent Application Publication WO 01/17048, by Nagai, in view of U.S. Patent Application Publication 2004/0053099, by Franklin et al. as applied to claim 5, and further in view of U.S. Patent Application Publication No. 2003/0150162, by Inagaki et al.

Claims 6 and 7 are dependent upon claim 5. For all the reasons set forth above, the Nagai structure with the metal spacer within the polymer sheets does not suggest to form a gasket of metal sheets, to provide a pillow structure with a gas-filled chamber, and to bond the pillow structure to the adjacent components to form a sealed joint. Without these features, Nagai does not show Applicants' invention in claim 5.

Also for the reasons set forth herein, Wakamatsu et al., JP '783, and Franklin et al. do not lead the practitioner to eliminate the spacer in Nagai, replace the polymer sheets with metal sheets, bond the metal sheets to the adjacent components, and eliminate the gaskets shown in

Nagai. Without this, the secondary references do not lead the practitioner from Nagai to Applicants' invention in claim 5.

Inagaki et al. is applied to disclose a seal in a fuel cell for a vehicle. However, Inagaki et al., like the other secondary references, does not show a gasket formed of metal sheets and including a gas-filled pillow structure that is diffusion bonded to the adjacent components, and so does not make up the short comings of Nagai.

Thus, the combined references do not suggest Applicants' fuel cell assembly in claim 5. It follows then that they cannot show the fuel cell assembly in claims 6 and 7 dependent upon claim 5.

Accordingly, it is respectfully requested that the rejection of the claims 6 and 7 be reconsidered and withdrawn, and that the claims be allowed.

VIII. CONCLUSION:

In view of the foregoing arguments, applicants respectfully submit that the recited claims are novel and unobvious. Further, a reversal of the rejections of record, or such recommendation or relief as equity may require is respectfully requested.

If there are any additional charges with respect to this Substitute Appeal Brief, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,



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CLAIMS APPENDIX

5. A fuel cell assembly comprising,
- first and second components in spaced, parallel relationship, and
- a gasket disposed between said first and second components, said gasket being formed of first and second sheet metal elements and including
- a planar region having an opening therein for passage of gas between said first and second components, said first and second sheet metal elements being bonded at said planar region, and
- a pillow structure surrounding said opening and extending from said planar region, said pillow structure defining a gas-filled chamber enclosed with said first and second sheet metal elements and being diffusion bonded to said first and second components to form a sealed joint therebetween.
6. A fuel cell assembly in accordance with Claim 5 wherein said assembly is an auxiliary power unit for a vehicle.
7. A fuel cell assembly in accordance with Claim 6 wherein said vehicle is selected from the group consisting of car, truck, boat, ship, airplane, and space vehicle.

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EVIDENCE APPENDIX

None.

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RELATED PROCEEDINGS APPENDIX

None.